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MONROE ELECTRONICS

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INSTRUCTION MANUAL

FOR

MODEL 152A

CORONATROL

Designed and Manufactured
by
MONROE ELECTRONICS, INC.
Lyndonville, New York 14098

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Appendix I

Large Signal Unipolar Speed-of-Response Limitation

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WARRANTY

Monroe Electronics, Inc. warrants each instrument and sub-assembly manufactured by them to be free from defects in material and workmanship for a period of one year after delivery to the original purchaser.

Liability under this warranty is limited to servicing, adjusting or replacement of defective parts (other than tubes, fuses or batteries) on any instrument returned to the factory for this purpose, transportation charges prepaid.

This warranty does not apply to products subjected to unauthorized repair or modification.

Before returning an instrument to the factory for any reason, notify us of the difficulty encountered; also the model and serial number of the instrument. We will furnish you with service and shipping instructions.

For warranty service in Europe, please direct all inquiries to:

MEM
Postfach 1520
8090 Wasserburg
Germany
Phone - 08071/8143

MONROE ELECTRONICS, INC.
100 Housel Avenue
Lyndonville, New York 14098

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Section 1

SPECIFICATIONS

A. H. V. Supply:

Constant Voltage Supply

--Voltage Range: ±500 to ±10,000 Volts D.C.
--Current Range: 0 to ±1000 μA
--Regulation: 0.01%

Constant Current Supply

--Regulated Current Range: 0.1 to ±1000 μA
--Compliance Range: ±500 to ±10,000 Volts D.C.
--Regulation: 0.01%

Stability

--Temperature: 0.01%/°C
--Time: 0.1%/month

Ripple 9rms at full load)

--RF ripple less than 0.1%
--Low frequency ripple less than 0.5 volts

Accurancy

--Voltage Mode: 0.2% of full scale
--Current Mode: 1.0% of full scale

Polarity Reversal

--A front panel switch is provided

Remote Operation

--Provision is made for remote operation via rear mounted jack. Mating connector supplied.

Metering

A single meter is provided with the following capabilities:
--Voltage: 0 - 10KV
--Total Current: 0-50, 100, 200, 500, 1000 μA
--Regulated Current: 0-50, 100, 200, 500, 1000 μA
--Accuracy: 3%

B. Amplifier:

Input

--Inverting, non-inverting or differential

--±10 Volts maximum

Output

--Constant Voltage at a fixed gain of 1000

--Constant Current (transconductance amplifier) with full scale regulated current output of from 1 μA to 1000 μA in decade ranges.

--Offset: Output may be offset by a front panel control to any value up to full scale.

--Rise Time: Less than 100 msec.

--Automatic Polarity Control senses the command polarity and operates relays to generate the desired output polarity. Relay speed of response is less than 25 msec.

C. General:

Power Requirements

--117 Volts A.C. ±10%, 60 Hz, 85 Watts

Size and Weight

--Standard 19" x 7" rack panel 15" deep, mounted in 20 3/4" x 9 5/8" x 15 3/4" cabinet.

--Net weight in cabinet: 50 lbs.

Section 2

INSTALLATION

A. Mounting:

The Model 152 is normally shipped in a cabinet and is intended for bench-top operation. It may, however, be removed from its cabinet by removing the four knurled thumbscrews securing the front panel to the cabinet and mounted in a standard 19 inch rack.

When operating the unit, precautions must be taken so as to not restrict cooling air flow.

B. Power Requirements:

The Model 152 is supplied with a six foot long power cord which mates with a standard, three prong, 117 V AC, grounded power outlet.

C. Grounding System:

The instrument chassis is normally automatically grounded when connected to the power line.

Three chassis ground terminals marked "GRD" are provided on the rear panel.

Amplifier input may be left "floating" or connected between either the inverting or non-inverting input and "GRD". A shorting link is provided to ground the unused input.

D. Output:

A 10 foot high voltage lead assembly is provided which mates with a high voltage connector on the rear panel marked "HV OUTPUT".

When operating in the constant voltage mode, the return lead is connected to chassis ground.

When operating in the constant current mode, the return path for the current to be regulated must be isolated from ground and returned to the binding post on the rear panel marked "CURRENT FEEDBACK".

If additional loads exist which are not to be regulated, they should be returned to chassis ground.

CAUTION: If the regulated current lead is placed in proximity to AC power wiring, excessive ripple in the regulated

output may result in the extreme case, regulation will be impaired. If this lead is routed near power wiring, is is advisable to shield it. The shield should be connected to "GRD".

E. Remote Operation:

Provision is made at the rear of the chassis for a remote OPERATE switch.

Connect SPST remote OPERATE switch between pins A and B of mating connector supplied.

To utilize remote OPERATE switch, the front panel OPERATE toggle switch must be in the REMOTE position.

Section 3

RECOMMENDED RECEIVING INSPECTION PROCEDURE (CONFIDENCE CHECK)

NOTE: This procedure is furnished in order that the user of the Monroe Electronics, Inc. Model 152A may become familiar with the operating controls of the instrument and some of its features in a brief period of time.

CAUTION

Corona which may be generated by high voltages within the range of this instrument produces ozone which may cause eye or throat irritation.

The following steps should be performed sequentially.

A. Operation as Voltage Source:

1. Set front panel controls as follows:
   a. "COMMAND/OFFSET" to "0.00"
   b. "MODE" to "CONST. V., 0-10KV"
   c. "FUNCTION" to "SUPPLY"
   d. "OFFSET" to "OFF"
   e. "OUTPUT POLARITY" to "-"
   f. "METER SWITCH" to "0-10KV".
   g. "OPERATE" toggle switch to "LOCAL".
2. Connect power cord to 117 V AC, ±10%, 60Hz, grounded power source.
3. Press "MAIN POWER" pushbutton switch. White lamp in "MAIN POWER" switch, green lamp in "STANDBY" switch, and blue lamp in "-" polarity indicator should light.

B. Check Polarity Indicator:

4. Place "OUTPUT POLARITY" switch in "+" position. Red lamp in "+" polarity indicator should light.
5. Press "OPERATE" pushbutton switch. Amber "OPERATE" light should light.
6. Turn "COMMAND/OFFSET" control slowly clockwise toward "10.00". This, as well as the indication on the meter, represents 10 kilovolts at the output of the supply which is located on the rear panel and is designated "H.V. OUTPUT".

Section 4

INTERNAL ADJUSTMENT PROCEDURE

A. General:

Normal operating procedure involves only the use of front panel controls as described in the previous OPERATION section.

The locations of printed circuit cards A-1 through A-4 are as identified on the top of the card cage. A-2 through A-4 are removable from the front of the Model 152 by loosening the captive screw in each and withdrawing the card. A-1 is located behind A-3 and may be removed by first removing A-3.

B. Internal Primary Adjustments:

Adjustments in this section are factory preset, stable, and will seldom require attention. Before attempting adjustments in this section, allow at least one hour for stabilization. Tests should be performed to ascertain that the adjustment is necessary. For convenience, modules may be operated from instrument power through the use of extension circuit board Model 302D listed as an accessory in the Maintenance Section, Section 6

For the following, the Model 152A is operated in the "STANDBY" mode.

Perform tests and adjustments in the order indicated.

NOTE: Unless otherwise specified, all voltages are measured relative to "GRD" post on rear chassis apron.

1. Plus 15 Volt Supply: 384A (A-1)

   Monitor the voltage at pin #10 with a suitable measuring instrument and, if necessary, adjust R-14 for 15 volts, ±0.1%.

2. Minus 15 Volt Supply: 384A (A-1)

   This supply is a slave supply utilizing the +15 volt supply on the same board for its reference.

   Monitor the voltage at pin #1 with a suitable measuring instrument and, if necessary, adjust R-28 for -15 volts, ±0.01% of the absolute output of the +15 volt supply.

for aging of the oscillator circuit components.

The procedure is as follows:

1. Set up front panel controls as follows:
   a. "COMMAND/OFFSET" to "10.00".
   b. "MODE" to "CONST. V., 0-10KV".
   c. "FUNCTION" to "SUPPLY".
   d. "OFFSET" to "OFF".
   e. "OUTPUT POLARITY" switch to "+".
   f. "METER SWITCH" to "0-10KV".

2. Connect a series string of ten, one megohm, 2 watt, 10%, carbon composition resistors from "H.V. OUTPUT" to "GRD".

3. Connect a suitable voltmeter from L-102 (end opposite oscillator) to chassis.

4. Turn on "MAIN POWER" and "OPERATE" switches.

5. Adjust "TUNE" (C-102) for lowest voltage at L-102 (approximately 14 volts). Tuning should produce a "dip".

   NOTE: Oscillator tuning is relatively non-critical.

D. Calibration: (R-113)

The attenuation network (R-112) is of necessity a carbon film network which is temperature compensated but one which can be expected to drift slowly with age. Its setting should, therefore, be checked annually to achieve most accurate performance.

It is justifiable to execute this setting to 0.1% accuracy after a one hour stabilization period.

A typical procedure is as follows:

1. Set up front panel controls as follows:
   a. "COMMAND/OFFSET" to "10.00".
   b. "MODE" to "CONST. V., 0-10KV".
   c. "FUNCTION" to "SUPPLY".
   d. "OFFSET" to "OFF".
   e. "OUTPUT POLARITY" switch to "+".
   f. "METER SWITCH" to "0-10KV".

2. Connect a calibrating instrument suitable for measuring 10,000 volts (DVM, bridge-type voltmeter, etc. with proper voltage divider) between "H.V. OUTPUT" and "GRD".

3. Turn on "MAIN POWER" and "OPERATE" switches.

4. Adjust "CAL." (R-113) for +10,000 volts, ±0.1% at "H.V. OUTPUT".

NOTE: "CAL." adjusts amplifier gain to 1000. In the above calibration procedure, the previously calibrated "COMMAND/OFFSET" is used to generate a 10 volt, ±0.1% command into the amplifier section of the instrument.

It is recommended that whenever it may become necessary to change the "HV REGULATOR" (3020) or "±15 VOLT REGULATED POWER SUPPLY" (384A), all adjustments in the above sections be verified and, if necessary, corrected to obtain optimum performance.

E. Meter Calibration:

Metering is provided primarily to indicate gross conditions of output voltage and current.

All of the total current (I_t) ranges indicate the total of the output current and the current in the divider consisting of R-112 and R-113. A current equal and opposite in polarity to the divider current is injected through R-106 and R-107 from "HV OUT/1000", the effect of which is to leave only the output current in the meter circuit.

Calibration of the "I_T" ranges is effected by setting the controls to produce +10,000 volts out and adjusting R-107 for a zero meter indication on the "I_T, 50μa" range.

All of the Regulated Current (I_R) ranges indicate regulated current only when the "MODE" switch is in one of the "CONST. I" positions.

As the shunts used in the current ranges are fixed resistors, it is necessary only to verify that their values are correct to within 1%.

The "0-10KV" range monitors voltage at the "HV OUT/1000" output.

3. ZERO 1: 3021 (A-2)

Ground the inverting and non-inverting amplifier inputs located on rear chassis apron.

Using a suitable voltmeter, monitor the voltage at TP-1 (white) and adjust "ZERO 1" for 0 volts, ±1mV.

4. ZERO 2: 3021 (A-2)

Place "FUNCTION" switch (front panel) in "AMP" position and "OFFSET" switch in "OFF" position. Monitor TP-3 (red) with a suitable voltmeter and adjust "ZERO 2" for 0 volts, ±1mV.

5. ZERO 3: 3020 (A-3)

Turn "COMMAND/OFFSET" (front panel) fully counter clockwise.

Using a suitable voltmeter, monitor the voltage at TP-3 (red) and adjust "ZERO 3" for 0 volts, ±0.1mV.

6. ZERO 2: 3020 (A-3)

Using a suitable voltmeter, monitor the voltage at "HV OUT./1000" binding posts (rear chassis apron). Adjust "ZERO 2" for 0 volts, ±0.1mV.

7. ZERO 4: 3020 (A-3)

Using a suitable voltmeter, monitor the voltage at TP-1 (white) and adjust "ZERO 4" for 0 volts, ±1mV.

8. Command Cal.: 3020 (A-3)

Set "COMMAND/OFFSET" (front panel) to 10.00. Place "FUNCTION" switch (front panel) in "SUPPLY" position.

Place "OUTPUT POLARITY" switch (front panel) in "-" position.

Using a suitable voltmeter, monitor the voltage at TP-3 (red) and adjust "COMMAND CAL." for +10.00 volts, ±0.1%.

C. Oscillator Tuning:

This adjustment may require periodic adjustment to compensate

Section 5

THEORY

A. Basic Principle:

Please refer to the simplified functional block diagram.

The Monroe Electronics, Inc. Model 152A Coronatrol is basically an operational amplifier whose output utilizes a high voltage RF power oscillator, rectifier, filter and polarity reversing switch.

Gain in the voltage mode is determined by a precision divider network between the high voltage output and ground. The output from this high voltage divider network is supplied to a voltage follower whose output is summed through matched precision resistors with a voltage generated by a reference supply.

In the current mode, the load becomes the feedback resistance. Load current and a precision current from the reference supply produce a null at the summing junction.

When the Model 152A is used as an amplifier, the reference supply is replaced by the external source. The reference supply is now free to provide an offset at the output if desired.

Selection of the controller function inserts an operational amplifier with uncommitted input and feedback impedances in the loop. This may be used to provide any controller transfer function within the capability of the supply and amplifier. The amplifier offset may be used to supply a set point against which the controller regulates.

B. Power Supplies:

1. Regulated ±15 Volt Supply (384-A)

The Model 384A provides plus and minus 15 volt power to the electronics in the system. Please refer to the P.C. card schematic 384A/1. The plus and minus 15 volt supplies are identical in design with the following exceptions.

1. The plus supply uses CR-4 as a voltage reference element, while the reference for the minus supply is the regulated output of the plus supply.

2. The polarity of the semiconductors in the minus supply is reversed to facilitate the negative output.

5. Any of a number of catastrophic failures which might cause temporary or permanent loss of power to the holding coil.

The +35 volt unregulated power to the power oscillator is immediately removed therby assuring a certain degree of safety to the operator and equipment.

Upon reapplication of the +26.5 volt regulated power, the "STANDBY" mode of operation is retained until the holding coil is reenergized by depressing the "OPERATE" pushbutton.

The indicator unit at the extreme right side of the Model 152A front panel serves two separate functions, those of indicating the output polarity in the upper two quadrants and, in the lower half, indicating overloading of the output. These functions will be described in Sections 5-E and 5-F-6b, respectively.

One or the other of the polarity indicating lamps will normally be illuminated at all times while the Model 152A is in the standby or operate mode.

D. High Voltage Power Oscillator:

The high voltage generating section of the Model 152A is a transistorized variation of the basic Armstrong oscillator. The resonant frequency is determined by transmitting type mica capacitors and the collector winding which is tapped for impedance matching. Series leak type bias is used.

Output coupling of the RF is accomplished by inductive means. Maximum efficiency is realized when the oscillator is tuned to the natural resonant frequency of the high voltage secondary and its distributed capacitance.

The output voltage is a direct function of the positive drive voltage which is derived from the +35 volt unregulated power supply through pass transistor Q-103. Control of the pass transistor will be discussed in Section 5-F-6a.

RF voltage from the high voltage secondary is rectified by CR-108 and filtered by either C-108 or C-109 (depending upon output polarity), R-109 or R-110 (depending upon output polarity) and C-110 and C-111. C-115, connected to the lower end of C-111, has a very low capacitive reactance at the operating frequency and places the lower end of C-111 virtually at ground.

Relay K-102 is a high voltage type which reverses the output polarity with respect to ground.

A pair of arcing spheres limit the maximum voltage which can be developed by the high voltage generator to approximately

12.5 KV. They are located so as to confine the large instantaneous current and high voltage arcing to the high voltage generating loop in the event of abnormal conditions such as:

1. A high voltage transient in excess of 12.5KV.

2. Operating in the constant current mode with no feedback.

3. Operating in the constant current mode with an excessively high current range selected.

Resistors R-108 and R-111 limit currents in the discharge paths of the RF filter capacitors to safe values.

E. Automatic Polarity Control (3022):

The primary function of this module is to drive relays K-1 and K-101 and K-102 to produce the desired polarities in the high voltage section, oscillator driver circuitry, meter circuit, reference/offset follower and to illuminate the correct polarity indicator. These relays are normally de-energized for a negative output.

A Schmitt Trigger Circuit normally derives its input from one of three sources:

1. +15 volts DC in the "-" position of the "OUTPUT POLARITY" switch from the regulated ±15 volt supply (output of the Schmitt Trigger switches negative).

2. -15 volts DC in the "+" position of the "OUTPUT POLARITY" switch from the regulated ±15 volt supply (output of the Schmitt Trigger switches positive).

3. 0 to ±10 volts DC in the AUTO position of the "OUTPUT POLARITY" switch from the "AMPLIFIER/ CONTROLLER INPUT" module.

Whenever the Schmitt Trigger Output is positive (due to a negative signal at its input), Q-2 will conduct, thus grounding the low end of all relays and energizing them.

When the Schmitt Trigger Output is negative, (due to a positive input signal), Q-2 is biased off deenergizing the relays.

CR-2 and CR-3 are protective devices which allow shortest possible relay response without destruction of Q-2 due to inductive "kickback".

F. High Voltage Regulator:

1. Reference/Offset Follower

supply and from the divider follower and the "AMPLIFIER/ CONTROLLER INPUT" module when the Model 152A is functioning as an amplifier or a controller. These currents are produced through matched carbon film resistors R-5 and R-6.

Its input in the current mode is the summation of the current generated through R-8, R-9, R-10 or R-11 by the reference source (the reference/offset follower when functioning as a supply or the AMPLIFIER/CONTROLLER INPUT module when functioning as an amplifier or a controller) and the current from the "CURRENT FEEDBACK" connector (the regulated load current). An additional input to the integrator in the current mode is supplied by the network comprised of C-114, C-115 and R-120 which serves to improve transient response of the high voltage output.

The integrator output polarity may be either positive or negative.

4. Initial Conditions Circuit

The initial conditions circuit consists of a field effect switch and a biasing network connected to the +35 volt unregulated power supply, the purpose of which is to discharge the integrating capacitor whenever the +35 volt supply line is interrupted and thereby cause integration to be from a low value of output to a higher value when power is reapplied.

5. Inverter

As the input signal to Q-4 must always be positive to produce a useful output, a unity gain inverting amplifier between the integrator output and the normally closed contacts of K-1 inverts the negative output signal from the integrator.

6. Oscillator Driver

a. Driver Amplifier

The oscillator driver circuit is a high gain power amplifier whose input is at Q-4 and whose useful output is taken at the emitter of pass transistor Q-103. It normally functions as a linear amplifier serving the purpose of controlling the drive to the input of the high voltage power oscillator.

A positive signal to Q-4 causes Q-4 to conduct thus providing bias for Q-5 which, in turn, biases Q-8, Q-102 and pass transistor Q-103 on. The value which the input to the high voltage power oscillator seeks is dictated by feedback from the high voltage output as previously described.

In the 0-10KV meter range, the voltage is measured at the HV OUT/1000 Output which is a 1/1000 replica of the high voltage output. Meter multipliers R-114 and R-115 serve to calibrate the meter movement in kilovolts with a full scale deflection corresponding to 10 kilovolts.

All currents are measured by direct means. Meter shunts R-116 through R-119 provide the upper current ranges for both total and regulated currents. The meter is not shunted in the 50 microampere ranges.

Regulated current is measured in the "CURRENT FEEDBACK" path. Diodes CR-115 and CR-116 limit the maximum voltage which may appear on the "CURRENT FEEDBACK" line to a safe value.

Total current is sensed in the high voltage ground return path, i.e., the "grounded" side of the high voltage supply.

As any current which flows between the "HV OUTPUT" and ground will be indicated on the meter and since a current which is linearly dependent upon the output voltage flows in the high voltage divider network R-112 and R-113, provision is made for "bucking" this current out of the meter via R-106 and R-107 and the HV OUT/1000 output. This produces a linear current which is equal and of opposite polarity to the undesired devider network current and results in only the load current being indicated by the meter.

CR-111 and CR-113 clamp the "grounded" side of the HV Power Supply to within approximately 0.6 volts of ground potential when the meter is not used in the I_T ranges. C-113 is an RF bypass capacitor.

Contacts on relay K-101 reverse polarity of the current applied to the meter as necessary for normal, upscale indication.

CR-109 and CR-110 protect the meter from current overload if the wrong range is inadvertantly selected. C-112 is an RF bypass capacitor.

Section 6

MAINTENANCE

Normal maintenance for this instrument should be limited to periodic cleaning using low pressure compressed air or a soft brush and adjustments described in the Adjustment Section.

In the event of catastrophic failure, a recommended breakdown of sections for trouble shooting is as follows:

A. AC Power:

1. Check line.

2. Check fuses.

B. DC Power:

1. ±15V supply (±0.1%).

2. +35V unregulated supply (+29 to +40V).

3. +26.5V regulated supply (±10%).

C. Power Oscillator:

One end of L-102 may be disconnected and the oscillator powered from an external, variable DC power supply capable of approximately 0 to 12 volts at 1 ampere, if this section is suspected.

D. Automatic Polarity Control 3022 (A-4):

Correct operation of this module may be checked by switching between "+" and "-" and observing that polarity indicator lights change and that relays K-1 on 3020 "HV REGULATOR" and K-101 and K-102 on main frame operate.

If A-4 is withdrawn, output polarity should be (-).

E. HV Regulator 3020 (A-3):

This board provides two separate functions.

1. COMMAND/OFFSET

Voltage between TP-3 and TP-2 should vary between zero and 10 volts ±0.1% as Command/Offset is varied. Polarity is dependent upon and should be the opposite of the output polarity commanded by the "OUTPUT POLARITY" switch

on "AUTOMATIC POLARITY CONTROL" module.

2. FEEDBACK AMPLIFIER

Please refer to Theory Section, Section 5.

F. Amplifier/Controller Input 3021 (A-2):

Please refer to Theory Section, Section 5.

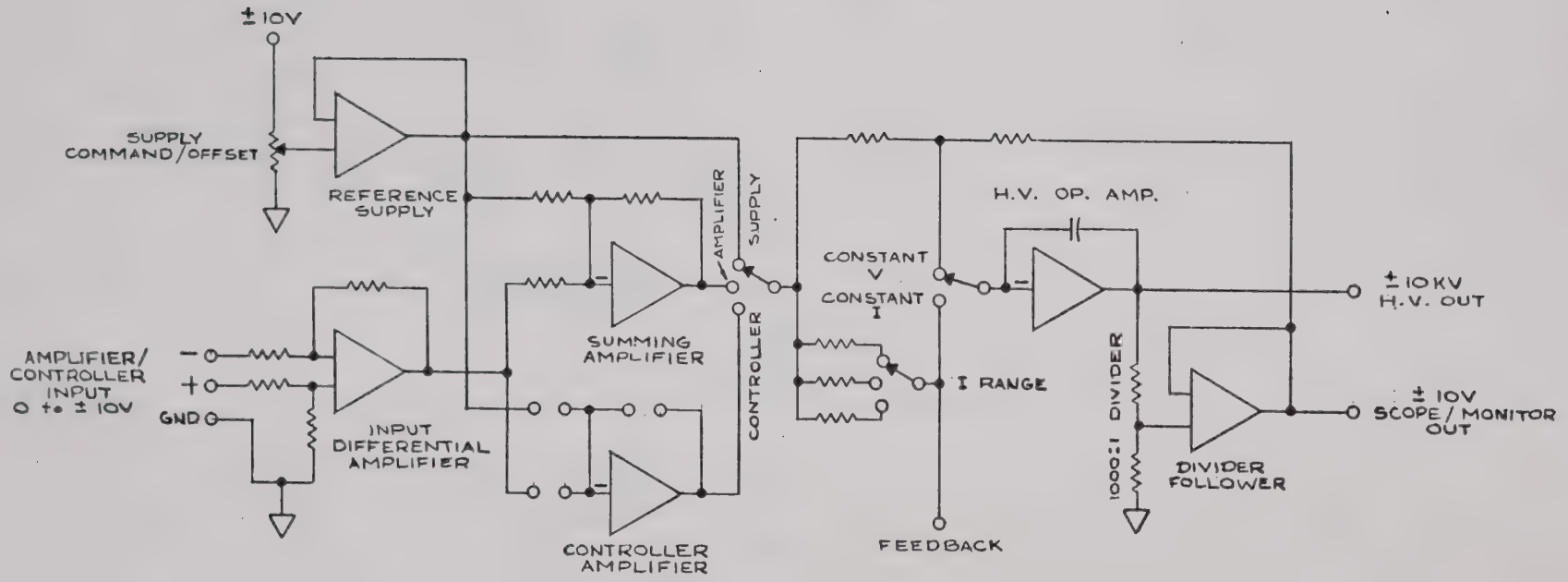
G. Model 152A Parts and Accessories:

Replacement madules are avainable at the factory. Factory repair of defective modules is recommended as many components employed in these modules are selected.

The following is a complete list of Model 152A interchangeable replacement parts and modules.

MODEL NO.	DESCRIPTION
302D	Extension Circuit Board
384A	±15 Volt Power Supply
3020	High Voltage Regulator
3021	Amplifier/Control Input Circuit Board
3022	Automatic Polarity Control Circuit Board
	10' High Voltage Cable with Connector

Specifications are subject to change without notice.



SIMPLIFIED FUNCTIONAL BLOCK DIAGRAM

		LOC.	LET.	REVISIONS	DATE
		SCALE		DATE	MONROE ELECTRONICS, INC.
		DRAWN	B&C	9-9-71	LYNDONVILLE, NEW YORK
		CH'KD.			MODEL 152 BLOCK DIAGRAM
NEXT ASSEMBLY	NO. REQ.	APP'D			

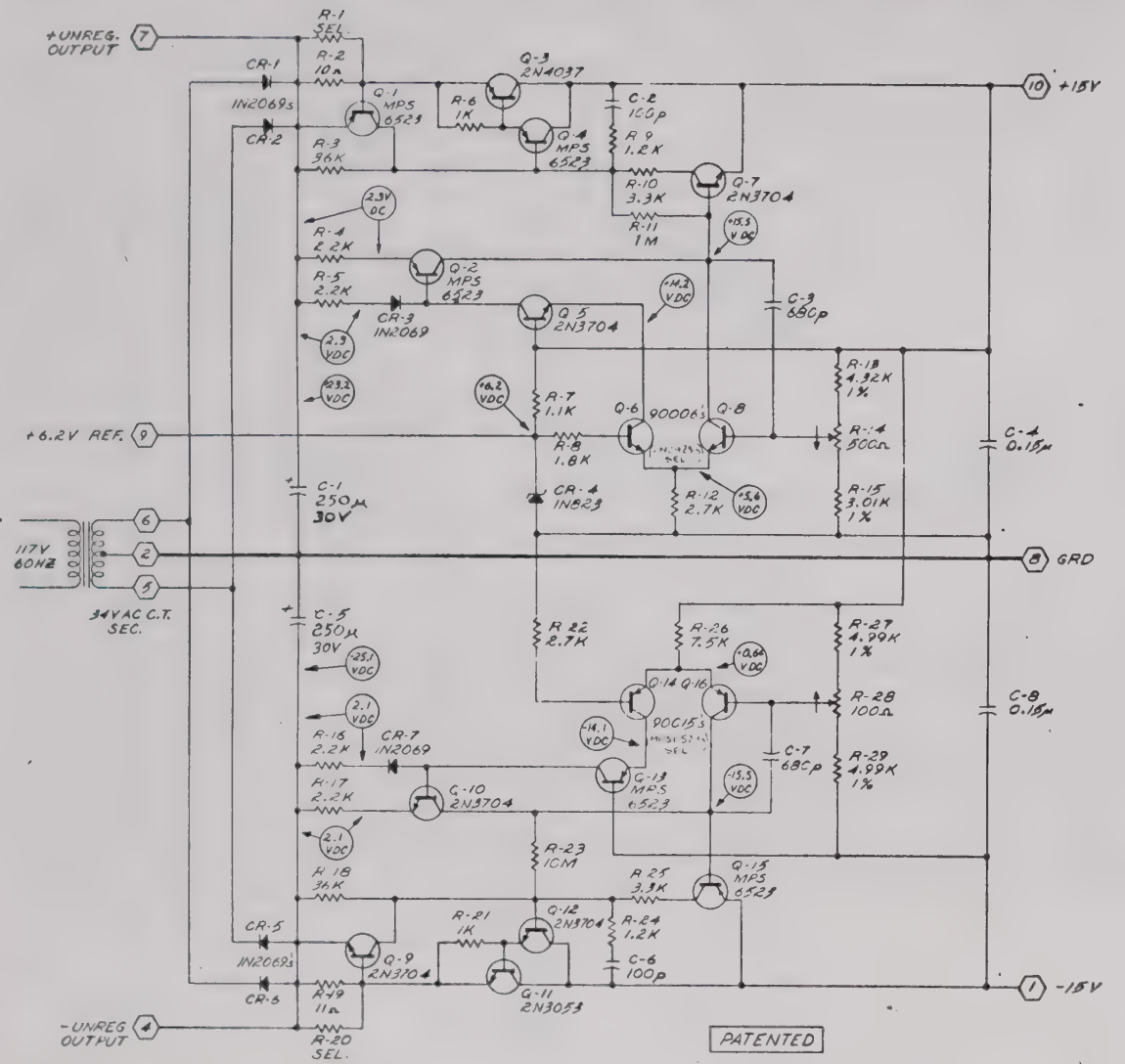
TOLERANCE UNLESS OTHERWISE SPECIFIED: DECIMAL ± .005 FRACTIONAL ± 1/64 ANGULAR ± 15'

MATERIAL

152/12

152/12

An instrumentation, circuitry designs and application data shown herein and related knowhow are CONFIDENTIAL and the property of Monroe Electronics, Inc. No use or disclosure thereof may be made without our written permission.



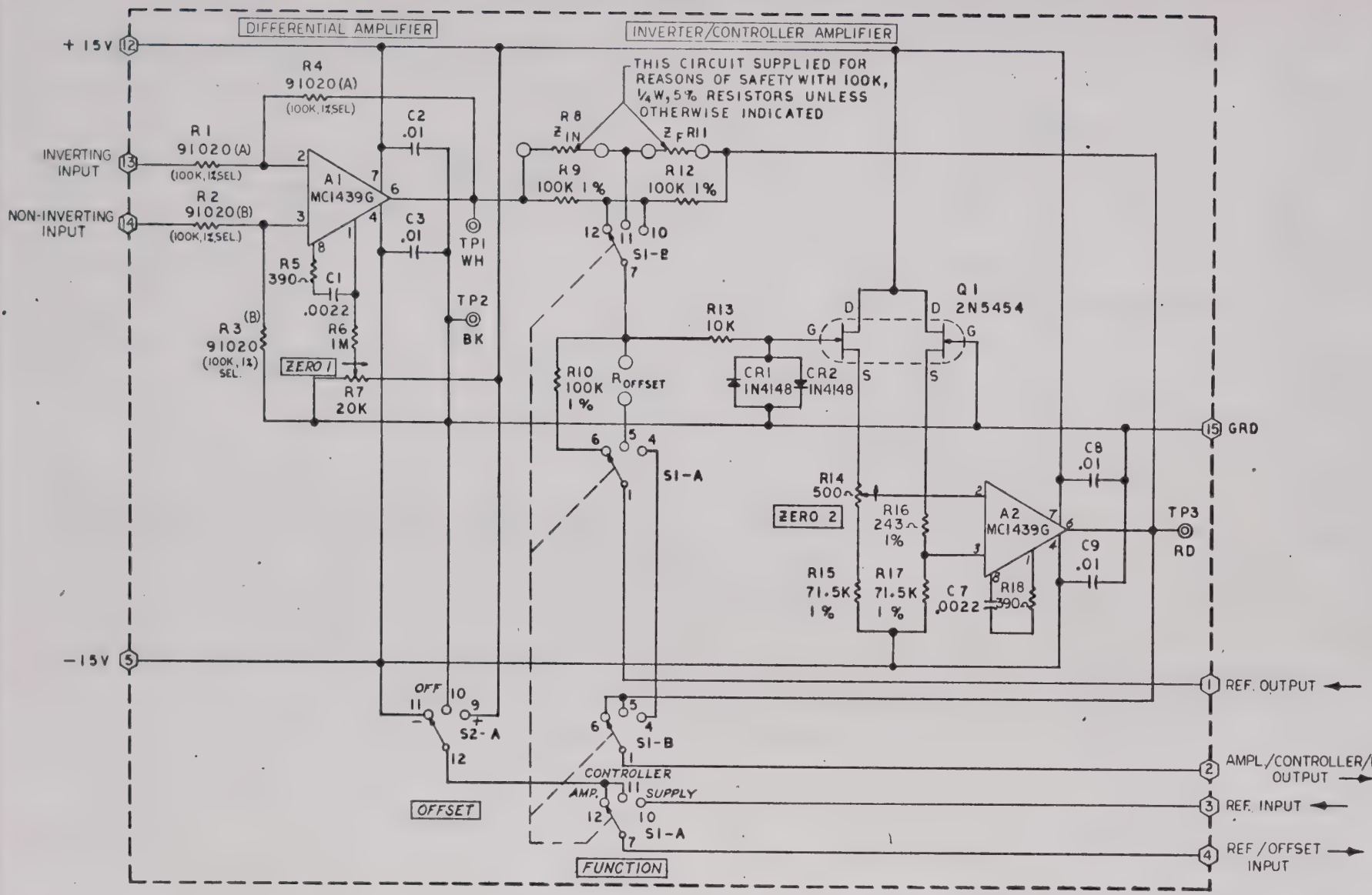
PATENTED

NOTE:
1. ALL RESISTORS ¼W, 5% EXCEPT AS NOTED
2. SEL = RESISTANCE VALUE FACTORY SELECTED
3. ALL VOLTAGES MEASURED WITH 20KΩ/V VOLTMETER, REFERRED TO COMMON UNLESS OTHERWISE INDICATED

KEY PIN 3

B	R11 WAS 10 M			SLW	8-2-79
	ADDED Q-6,-8,-14,-16 TYPE NOS.			ECL	11-16-70
					MONROE ELECTRONICS, Inc.
					MIDDLEPORT N.Y.
		RLD	3-14-68		MODEL 384A ±15V ± 50MA ±0.1% REG P.S.
					384A/1

384A/1



NOTES:
UNLESS OTHERWISE SPECIFIED
1. ALL RES. ARE 1/4W, ±5%
2. ALL CAP. IN μF AT 200V.

KEY PIN 6

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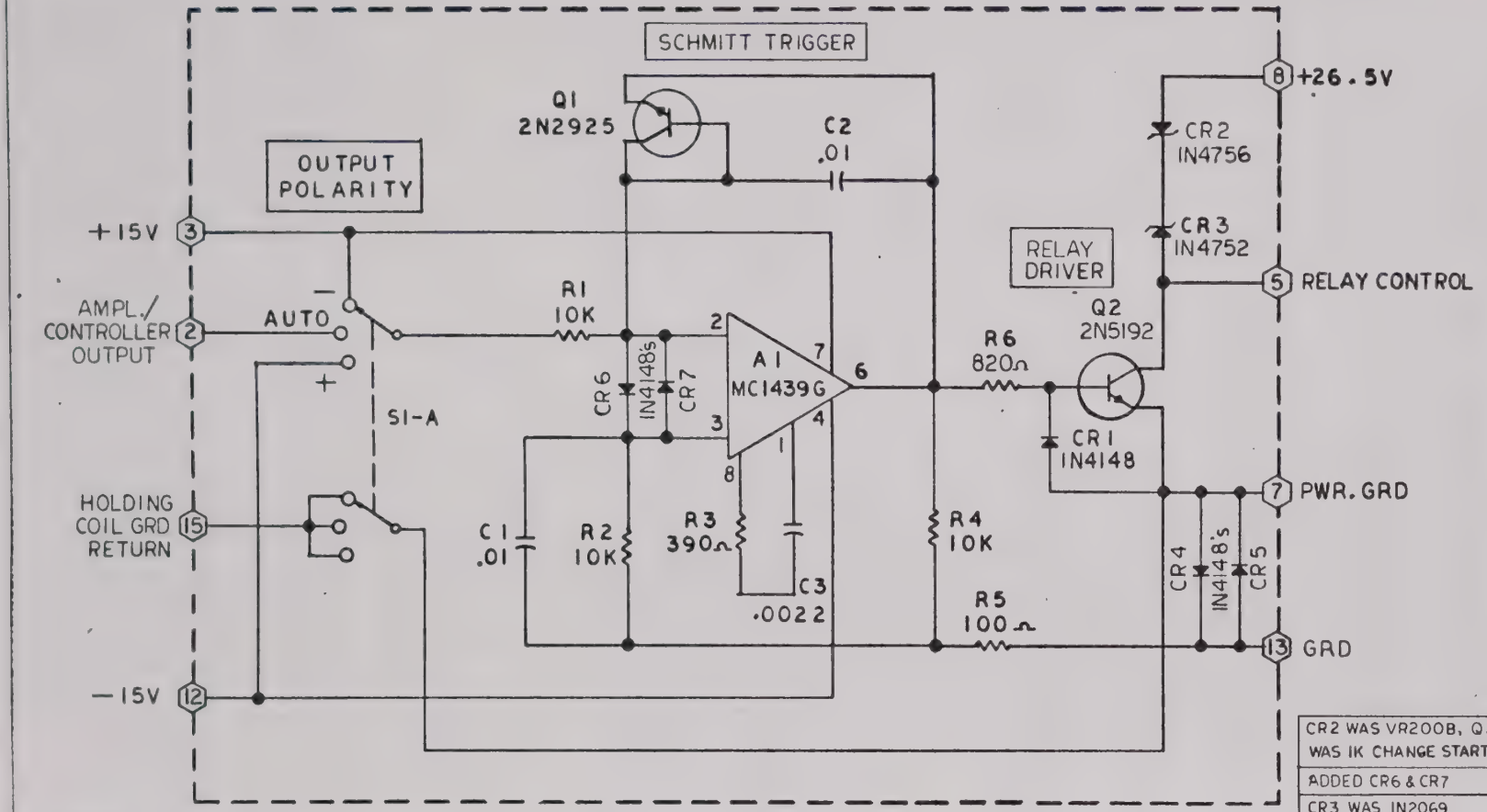
MONROE ELECTRONICS, INC.
MIDDLEPORT, N.Y.

MODEL 3021
AMP./CONTROLLER INPUT

3021/1



NOTES

1. ALL RESISTORS ARE ¼ WATT ±5%.
2. ALL CAPACITORS ARE IN MICROFARADS AT 200V.
3. KEY PIN 9

CR2 WAS VR200B, Q2 WAS MJE340 & R6 WAS 1K CHANGE STARTING S/N 107	B.C.	12-31-70
ADDED CR6 & CR7	B.C.	10-30-70
CR3 WAS IN2069	B.C.	8-26-70
ADDED CR1,4 & 5	B.C.	8-26-70

MONROE ELECTRONICS, Inc.
MIDDLEPORT, N. Y.

MODEL 3022
AUTO POLARITY CONTROL

3022/1

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5D

APPENDIX I

MODEL 152 CORONATROL

LARGE SIGNAL UNIPOLAR SPEED-OF-RESPONSE LIMITATION

In using the Model 152 CORONATROL as an amplifer or controller with one polarity of output, an inherent speed-of-response limitation exists.

The high voltage output of this instrument employs a variable amplitude RF High Voltage source which is demodulated (rectified) to generate the desired high voltage direct current output.

If the RF high voltage is suddenly reduced to zero, the DC output can only decay as fast as the filter capacitors can discharge through the resistive load on these capacitors.

These capacitors are equivalent to a single 750 picofarad capacitor. The resistive load on this capacitance can, with no external resistive load, be the 100 megohm internal divider thus providing a decay time constant of:

$$T_{MAX} = C_S \times R_D = (750 \times 10^{-12})\ (100 \times 10^{-6})$$

$$= 75 \text{ milliseconds.}$$

This decay time constant can be reduced by slightly more than an order of magnitude by resistive loading of the supply output. For maximum rated output, the output load resistor would be:

$$R_L = \frac{V}{I} = \frac{10 \times 10^{3}}{1 \times 10^{-3}} = 10 \text{ Meghohms}$$

This will thus reduce the decay time constant to slightly less than 7.5 milliseconds:

$$T_{MIN} = C_S\ (R_D // R_{L_{MIN}})$$

$$= (750 \times 10^{-12})\ (9.09 \times 10^{6})$$

$$= 6.82 \times 10^{-3} \text{ Seconds.}$$

Thus where best speed-of-response is desired and the output load is significantly less than rated load, an additional load should be added in parallel with this load to achieve rated load and thus fastest speed-of-decay for the filter capacitor voltage.

The above discussion indicates the square wave performance which can be anticipated from the CORONATROL. Should an output other than a square wave be sought, one must consider the maximum slope desired from the instrument. The problem relates itself to the decay rate of the above described RC circuit.

RECO

PART NO.

10G30FS

1N2069

1N4001

1N4750

2N3055

2N3766

384A/22

387

3020/22

3021/22

3022/22

3AG

3AG

NE-2

VS-247

The maximum decay rate is dictated by the voltage on t at a given instant in time and the resistance availabl that capacitance.

Bear in mind that the primary limitation is the decay zero voltage which is a negative slope for positive ou and a positive slope for negative output voltages.

This maximum decay slope can be simply calculated as f

Consider a capacitor, C_D, charged to a voltage V at a g in time and shunted by an effective load R_{Le}, then

$$V = Q/C \quad \text{in general}$$

therefore:
$$\frac{dV}{dT} = \frac{i}{C_D}$$

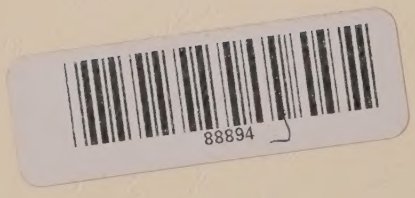
but
$$i = \frac{V(t)}{R_{Le}}$$

thus
$$\frac{dV}{dt}_{MAX} = \frac{V(t)}{R_{Le}C_D}$$

Remember, the distributed capacitance, C_D, equals 750 pf capacitance in the external load. Thus, if a 250 pf loa existed and a 20M external load existed, the effective l would be 20 meghoms in parallel with 100 megohms or 16.7 Similarly, the total capacitance would be 750pt plus 250p Thus at the instant the supply output voltage is 5KV,

$$\frac{dV}{dt}_{MAX} = \frac{5\times10^{3}}{16.7\times10^{6} \times 1000\times10^{-12}} = 299.4\times1$$

The system cannot decay at a rate exceeding this slope th the speed-of-response of the system.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